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| 学位の種類 | 博士（医学） |
| 報告番号 | 甲第１７１５号 |
| 学位記番号 | 第１２１３号 |
| 氏名 | 堀場　充哉 |
| 授与年月日 | 令和１年 ９月 25 日 |
| 学位論文の題名 | Impaired motor skill acquisition using mirror visual feedback improved by transcranial direct current stimulation (tDCS) in patients with Parkinson's Disease<br>（パーキンソン病の鏡像視覚フィードバックを用いた運動技能習得の障害は、経頭蓋直流電気刺激によって改善された）<br><br>Frontiers in Neuroscience Vol.13: 602. doi: 10.3389/fnins.2019.00602. eCollection 2019. |
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Recent non-invasive brain stimulation techniques in combination with motor training can enhance neuroplasticity and learning. It is reasonable to assume that such neuroplasticity-based interventions constitute a useful rehabilitative tool for patients with Parkinson's Disease (PD). Regarding motor skill training, many kinds of tasks that do not involve real motor movements have been applied to PD patients. In a motor imagery task, motor cortical excitability, and brain activation areas during hand action imagination were reduced and altered in PD patients. However, action observation training of finger movements improved the spontaneous rate of finger movements in PD patients. Moreover, PD patients showed action observation related facilitation of grasping movement only when the model was a Parkinsonian subject. Based on these findings, fine visual input seems to be important for the improvement of motor dysfunction in PD patients without real motor training.
The purpose of this study is to elucidate whether motor skill training using mirror visual feedback (MVF) is useful to patients with PD in order to improve untrained hand performance dependent on the time course of training; and whether MVF combined with anodal transcranial direct current stimulation (tDCS) over primary motor cortex (M1) causes an additional effect based on increased motor cortical excitability.
Eighteen right-handed patients with PD in the off-medication state and 10 age-matched healthy subjects (HS) performed four sessions of right-hand ball rotation using MVF (intervention) on two separate days, 1 week apart (day 1 and day 2). HS subjects received only sham stimulation. The intervention included four sessions of motor-skill training using MVF for 20 min comprised of four sets of training for 30 s each. PD patients were randomly divided into two intervention groups without or with anodal tDCS over the right M1 contralateral to the untrained hand. As the behavior evaluation, the number of ball rotations of the left hand was counted before (pre) and immediately after (post) intervention on both days (pre day 1, post day 1, pre day 2, and post day 2). Motor evoked potential (MEP), input-output function, and cortical silent period were recorded to evaluate the motor cortical excitatory and inhibitory system in M1 pre day 1 and post day 2.
The number of ball rotations of the left hand and the facilitation of MEP by intervention were significantly impaired in patients with PD compared to HS. In contrast, if anodal tDCS was applied to right M1 of patients with PD, the number of ball rotations in accordance with I-O function at 150% intensity was significantly increased after day 1 and retained until day 2.
This finding may help provide a new strategy for neurorehabilitation improving task-specific motor memory without real motor movements in PD.